Tables

Chapter Three - Facility Requirements

The purpose of this chapter is to identify improvements necessary to bring the general aviation facilities at Lake Hood and ANC into compliance with design standards and guidelines, accommodate anticipated demand, and address other issues related to the ongoing operation of the facilities. The public and members of the Technical Advisory Committee (TAC) identified many issues at meetings held in April 2004. The TAC also identified general aviation facility improvements needed during the "Perfect World" workshop held in July 2004. Where appropriate, facility requirements presented in this chapter are based on forecasts of aviation demand presented in Chapter Two and include short term (2008), intermediate term (2013) and long term (2023) planning horizons.

One assumption regarding general aviation facilities at Lake Hood and ANC is that the current division of aircraft types between Lake Hood and ANC will generally continue in the future. ANC will continue to accommodate all fixed wing turbojets and helicopters, as well as larger and heavier fixed wing turboprop and piston general aviation aircraft. Lake Hood will continue to be used almost exclusively by small, single- and twin-engine piston aircraft. Previous airport planning and development has supported this assumption for safety and efficiency reasons. Small aircraft at Lake Hood are better protected from damage by jet blast and rotor wash, and the facilities at Lake Hood can meet less demanding and less costly requirements than those at ANC.

Because safety is the first goal of this GA Plan, aviation accidents at the LHD and Z41 facilities were reviewed to learn of improvements that might reduce the number and severity of future accidents. A review of NTSB accident records for the last ten years (September 23, 1994-September 23, 2004) found that of 148 accidents that occurred in the Anchorage vicinity, 23 were at or near Z41 and 12 were at or near LHD.

The probable causes of the accidents at Z41 and LHD were equipment failure or pilot, instructor, or other human error. Weather conditions were a factor in some of the accidents. Airport facilities were not deemed the probable causes of any of the accidents; however, the circumstances of the accidents emphasize the importance of adequate runway safety and taxiway/taxilane object free area, the need for clear visibility between intersecting runways, the value of runway protection zones cleared of incompatible activity, and the potential hazards of surfaces shared by aircraft and vehicles.

Only five of the 28 accidents that occurred at ANC in the last 10 years involved general aviation flights and only three of the general aviation accidents at ANC were in small

aircraft. Two of the commercial service aircraft accidents at ANC were bird strikes, which highlights the danger of bird habitat being near an airport.

3.1 Lake Hood (LHD and Z41) Facilities

This section contains analyses of the airside and landside facilities, including runways, waterlanes, imaginary surfaces, taxiways, taxilanes, lighting, marking, navigational aids, aircraft parking, buildings, lease land, surface access, and security.

The following is an unconstrained facility analysis. Not all of the Lake Hood facility requirements identified in this chapter will be accommodated in all of the airport development alternatives analyzed in the next phase of the GA Plan. The reason for this approach is that Lake Hood is severely constrained from resolving issues and satisfying demand with capital improvements. The primary constraint is limited funding, although a shortage of suitable land for development is also a significant constraint. Some alternatives will assume that a portion of demand for facilities, particularly float slips, will be met at airports other than Lake Hood, or will remain unsatisfied.

3.1.1. Airfield Assessment Criteria

FAA Advisory Circular 150/5300-13, Change 7, *Airport Design*, is the primary source of criteria used to assess LHD and Z41. Many of the FAA standards in *Airport Design* are keyed to the Airport Reference Code (ARC). The ARC relates to a system designed by the FAA to define airport facility standards appropriate for the aircraft using a particular airport. The first component of the ARC refers to Aircraft Approach Category and the second component is the Airplane Design Group. Table 3.1 explains the components of the ARC.

Table 3.1
Airport Reference Code Components

Aircraft Approach Category		
Approach Category	**Approach Speed (knots)**	**Typical Aircraft**
A	Less than 91	Cessna 150, 172, 206, 208
B	91 to 120	Beech 1900, King Air; Piper Navajo
C	121 to 140	Boeing 727, 737, 757, 767; Gates Learjet 35
D	141 to 166	Boeing 747, 777; Gulfstream IV, V
E	166 or more	Lockheed SR-71 Blackbird
Airplane Design Group		
Design Group	**Wingspan (feet)**	**Typical Aircraft**
I	Less than 49	Cessna 150, 172, 206; Piper Navajo
II	49 to 78	Beech King Air; Cessna 208 Caravan
III	79 to 117	Boeing 727, 737Gulfstream V
IV	118 to 170	Boeing 757, 767
V	171 to 214	Boeing 747, 777
VI	214 or more	Lockheed C-5B Galaxy

The ARC relates to the most demanding aircraft type that regularly uses the airport; regular use is defined as at least 500 annual itinerant operations, which equates to an average of about one departure per weekday. The design aircraft identified by the 1999 Lake Hood Seaplane Base Airport Layout Plan was the DeHavilland DHC Beaver, ARC A-I.

The LHD and Z41 facilities are designed for ARC A-I, small aircraft exclusively (maximum 12,500 pounds gross takeoff weight). Runway 13-31 is limited to aircraft no heavier than 9,000 pounds and the waterlanes are limited to aircraft no heavier than 12,500 pounds. A small portion of the fleet based at Lake Hood are larger and faster, such as the Piper Navajo (multi-engine piston, ARC B-I), Cessna 208 Caravan (turboprop, ARC A-II), and the Beech King Air (turboprop, ARC B-I and B-II). Typically, these aircraft use the paved runways available at ANC, which are designed for ARC D-V. The greater runway length compared to 13-31's 2,200 feet is probably the main reason for using ANC, but the surface, bearing strength, more frequent winter maintenance, and availability of instrument approaches are other reasons.

Chapter Two indicated there are 36 multi-engine piston and four turboprop aircraft based at Lake Hood now. By 2023, the forecast numbers are 36 multi-engine piston aircraft and six turboprops. These multi-engine piston and turboprop aircraft are in ARCs A-I, A-II, B-I, and B-II. It is probable that Lake Hood-based aircraft provide enough activity to justify ARC B-II for Runway 13-31; however, the expense to upgrade the runway and taxiways to ARC B-II standards might be difficult to justify, considering the availability of three runways at ANC that exceed ARC B-II standards. Nevertheless, previous planning

studies have proposed B-II facilities at Lake Hood and some TAC members support them now. Removing smaller aircraft from the ANC airfield could increase the total capacity for aircraft operations at the Airport (ANC, LHD, and Z41), in addition to improving convenience and efficiency for several operators based at Lake Hood. This chapter lists ARC B-II standards and A-I standards for aircraft over 12,500 pounds, along with A-I (small aircraft only) standards for Runway 13-31 and associated areas, because some development options considered in the alternatives phase of the master plan may use more demanding criteria than A-I.

FAA design standards are also keyed to the approach visibility minimums of instrument approaches to runways. There are no instrument approaches at Lake Hood, and discussions about providing instrument approaches with airport users and the FAA have led to the assumption that Lake Hood will always be limited to visual operations, as long as the ANC runways, with their instrument approaches, are available to aircraft based at Lake Hood.

3.1.2. Airfield Configuration and Condition

The topics covered in this section are airfield capacity, runway orientation, runway length, and runway surface and condition.

Airfield Capacity

According to Chapter Two, annual aircraft operations at Lake Hood are projected to increase from 58,354 in 2003 to between 67,231 and 74,966 in 2023. Table 2.4 showed that Lake Hood aircraft operations in each year from 1989 through 1997 were over 80,000, peaking at 91,589 operations in 1994. Operations in FY 1985 reached 100,023, according to the 1999 Lake Hood Seaplane Base Airport Layout Plan. Based on the historically higher levels of aircraft operations at Lake Hood, it can be concluded that the runway and waterlanes have adequate capacity to accommodate the demand through 2023.

FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay,* contains capacity estimates for several airfield diagrams and mix indices. The diagram for a single runway airfield with a parallel taxiway, adequate exit taxiways, and low use by aircraft over 12,500 pounds has an annual capacity of 230,000 aircraft operations and an hourly capacity of 98 visual operations. A second parallel runway could increase the capacity to as many as 370,000 annual operations. According to the diagrams, intersecting runways do not increase capacity, and diverging or converging runways provide only modest capacity increases. Consequently, 230,000 might be considered a reasonable estimate of Lake Hood's annual capacity for aircraft operations, excluding consideration of delays to Lake Hood traffic resulting from ANC traffic.

If any airport development alternatives consider new or realigned runways or waterlanes, the following should be considered:

- For simultaneous visual operations, parallel runways must be at least 700 feet apart, measured between centerlines. Where wake turbulence is a factor, parallel runways must be at least 2,500 feet apart for simultaneous visual operations. Wake turbulence is a factor on the ANC runways, because they are used by heavy aircraft (B-757 and heavier).
- Lake Hood has four takeoff and landing surfaces with four different alignments, none parallel to the two alignments of ANC's runways (14-32 and 6-24). If the takeoff and landing surfaces at Lake Hood were more parallel to ANC's runways, overall airport capacity would increase. Past planning studies have proposed such improvements: replacing the N-S and NW-SE Waterlanes with a single waterlane parallel to ANC's Runway 14-32 (a north-northwest/south-southeast alignment) and replacing Runway 13-31 with a runway parallel to Runway 14-32.
- If fewer aircraft based at Lake Hood used the ANC runways, the capacity of the whole Airport (ANC, LHD, and Z41) would increase. This is because, at ANC, Air Traffic Control (ATC) must maintain more separation between small, slow aircraft (Approach Category A and B) and larger jets (Approach Categories C and D). Extra separation is also needed for the subsidence of wake turbulence when small aircraft takeoff or land after heavy aircraft.

Runway Orientation

The most desirable runway orientation has the highest wind coverage and the least amount of crosswind. Runways should be oriented with the prevailing wind, so aircraft can land and takeoff into the wind. Wind coverage is the percent of the time crosswind components are below an acceptable velocity. The desired wind coverage for an airport is 95 percent, using maximum crosswind speeds that are defined for different sizes of airplanes (lower for smaller airplanes). For the smallest airplanes, which are the using fleet at Lake Hood, the acceptable crosswind component is 10.5 knots. Wind coverage, based on observations from 1954-1978, is as follows:

Runway 13-31	98.9%
N-S Waterlane	97.6%
E-W Waterlane	92.0%
NW-SE Waterlane	97.5%
Combined	100.00%

Runway 13-31 provides adequate wind coverage for wheeled aircraft activity. The E-W Waterlane alone does not provide 95 percent coverage. Waterlane wind coverage would

exceed 95 percent with the combination of the E-W Waterlane and either of the two crosswind waterlanes.

One of the identified issues for the GA Plan was the need for a north-south waterlane in Spenard Lake for use by aircraft based at Spenard Lake. While there is an N-S Waterlane in Lake Hood, providing more than adequate wind coverage, there are safety concerns for floatplanes making the long taxi between Lakes Hood and Spenard in water made turbulent by very strong south winds. Because of this concern, ATC allows south landings in Spenard Lake when the wind from the south is more than 15 knots.

Runway Length

The ARC does not determine the runway length needed at an airport. FAA methodology for determining runway length depends on a combination of factors, such as aircraft performance characteristics, operating weight, temperature, airport elevation, runway gradient, and runway surface condition. The FAA's computer program for determining runway length produced the results in Table 3.2. The 2,200-foot length of Runway 13-31 is adequate for approximately 75 percent of small airplanes with less than 10 passenger seats. Some members of the TAC have indicated that Runway 13-31 needs to be longer.

Table 3.2
Runway Length Analysis

Family of Aircraft	Runway Length
Small airplanes with approach speeds of less than 30 knots	300 feet
Small airplanes with approach speeds of less than 50 knots	810 feet
Small airplanes with less than 10 passenger seats	
75 percent of these small airplanes	2,270 feet
95 percent of these small airplanes	2,800 feet
100 percent of these small airplanes	3,320 feet
Small airplanes with 10 or more passenger seats	3,840 feet

Source: FAA software, Airport Design, which incorporates FAA Advisory Circular 150/5235-4, Runway Length Requirements for Airport Design

Input: 71' elevation, 65 degrees F mean daily maximum temperature of the hottest month, 5'-15' maximum difference in runway centerline elevation, wet and slippery runway

FAA Advisory Circular 150/5395-1, *Seaplane Bases*, states that water operating areas should be at least 2,500 feet in length, increased by 7 percent per 1,000 feet of elevation. Consequently, the required length at Lake Hood is 2,512 feet. The E-W

Waterlane, 4,540 feet long, exceeds this minimum requirement, but the other two waterlanes are shorter than 2,512 feet. FAA Advisory Circular 150/5235-4, *Runway Length Requirements for Airport Design*, states that a crosswind runway should have a length of at least 80 percent of the primary runway length. This is because takeoff and landing into a strong wind requires less distance than when the wind is calm. The N-S Waterlane is 1,930 long and the NW-SE Waterlane is 1,370 feet long. Both are shorter than 80 percent of the primary waterlane length (3,632 feet) and shorter than 80 percent of the primary runway's required length (2,010 feet). The short length of the NW-SE Waterlane may be the reason one LHD user has suggested expanding the lake to provide more usable maneuvering space for southeast landings.

Runway Surface and Condition

Gravel is the preferred runway surface for aircraft with tundra tires. The Alaska Supplement of the Airport Facility Directory reports that the gravel-surfaced Runway 13-31 is in good condition.

Lake Hood does not have a paved runway. Some users of the gravel runway would prefer to operate on a paved surface and some operators of Lake Hood-based aircraft that use the ANC runways now would prefer to use a paved runway located at Lake Hood. The 1989 Anchorage International Airport Master Plan proposed a new 3,500-foot long paved runway and new adjacent parallel gravel runway. For these reasons, Lake Hood development alternatives should examine adding a paved runway. Providing a paved runway at Lake Hood would reduce, but not eliminate, the need for Lake Hood operators to use ANC. ANC runways would continue to be needed for crosswind and instrument conditions. Options for providing both paved and gravel runways include:

- placing the two runways at least 700 feet apart to allow simultaneous operations
- placing the gravel runway so it can be used as a parallel taxiway for the paved runway
- placing the two runways immediately next to each other
- providing gravel strips about 300 feet long at the ends of the paved runway

While the provision of a paved runway at Lake Hood is an option, maintaining a water surface for floatplanes is a necessity, because Lake Hood is the only public floatplane facility in the Municipality of Anchorage. The need for some improvements to the condition of floatplane operating areas has been identified. Airport users, particularly those with float slips on Spenard Lake, have reported the need for bank stabilization on the shoreline. They identified waves created by excessive taxi speed as contributing to the problem of bank erosion. In 2004, grass began growing in the water, which created a hindrance to aircraft operations. The Airport has responded by authorizing slip permit

holders to cut the grass at their slips, purchasing a weed-eating boat, and investigating prevention methods.

3.1.3. FAA Runway Design Standards

Table 3.3 compares existing Runway 13-31 dimensions with those required for ARC A-I, according to *Airport Design*. In case an airport development alternative considers a new ARC B-II runway, the standards for ARC B-II also appear in Table 3.3.

Table 3.3
Runway Design Standards for Z41

Design Category	Existing Conditions	Required for ARC A-I	Required for ARC B-II
Runway Centerline to Parallel Taxiway/Taxilane Centerline	150 feet	150**/ 225 feet	240 feet
Runway Centerline to Edge of Aircraft Parking	200 feet	125**/ 200 feet	250 feet
Runway Width	70 feet	60 feet	75 feet
Runway Shoulder Width*	NA	10 feet	10 feet
Runway Blast Pad Width*	NA	80 feet	95 feet
Runway Blast Pad Length*	NA	60**/ 100 feet	150 feet
Runway Safety Area (RSA) Width	120 feet	120 feet	150 feet
RSA Length Beyond Each Runway End	240 feet	240 feet	300 feet
RSA Longitudinal Gradient	TBD	+/- 2% per 100 feet**	+/- 2% per 100 feet**
Object Free Area Width (OFA)	250 feet	250**/ 400 feet	500 feet
OFA Length Beyond Each Runway End	240 feet	240 feet	300 feet
Obstacle Free Zone (OFZ) Width	120 feet	250 feet	400 feet
OFZ Length Beyond Each Runway End	200 feet	200 feet	200 feet
Threshold Siting Surface Distance From Runway End	0 feet	0 feet	0 feet
Threshold Siting Surface Inner Trapezoid Width	250 feet	250**/ 400 feet	400 feet
Threshold Siting Surface Outer Trapezoid Width	700 feet	700**/ 1000 feet	1,000 feet
Threshold Siting Surface Length of Trapezoid Section	2,250 feet	2,250**/ 1500 feet	1,500 feet
Threshold Siting Surface Length of Rectangular Surface	2,750 feet	2,750**/ 8500 feet	8,500 feet
Threshold Siting Surface Slope	20:1	20:1	20:1
Runway Longitudinal Gradient***	.22%	+/- 2%	+/- 2%
Runway Traverse Gradient	TBD	1% to 2%	1% to 2%

Note: All standards are for runways with visual approaches.
**Shoulders and blast pads are not usually required for gravel runways.*
***Small aircraft only (max. 12,500 lbs)*
****Maximum rise in grade for total area = 2%. Maximum descent in grade for total area = -5%.*

Runway 13-31 meets the ARC A-I (small) standards listed in Table 3.3. Runway 13-31 also complies with the longitudinal line of sight requirement. Acceptable runway profile

criteria permits any two points five feet above the runway centerline to be visible for the entire length of the runway.

Neither Z41 nor LHD complies fully with the Runway Protection Zone (RPZ) design standard, shown in Table 3.4. The Runway Protection Zone (RPZ) is a trapezoidal area located beyond the end of the runway. Its primary function is to enhance the protection of people and property on the ground. FAA requires that the airport owner own or control the area of land encompassed by the RPZ to keep it clear of incompatible activities. Land uses prohibited from the RPZ are residences and places of public assembly, including churches, schools, hospitals, office buildings, shopping centers, and other uses with similar concentrations of people. Some uses are permitted, provided they do not attract wildlife, are outside the Runway Object Free Area, and do not interfere with navigational aids. Automobile parking facilities, although discouraged, may be permitted. Fuel storage facilities should not be located in the RPZ.

Table 3.4
Runway Protection Zone Standards

RPZ Dimension	Required for ARC A-I	Required for ARC B-II
Runway Protection Zone 200 Feet Beyond the Runway End	250*/ 500 feet	500 feet
Runway Protection Zone 1,200 Feet Beyond the Runway End	450*/ 700 feet	700 feet
Runway Protection Zone Length	1,000 feet	1,000 feet

Note: All standards are for runways with visual approaches.
**Small aircraft only (max. 12,500 lbs)*

Several of the Lake Hood RPZs required for ARC A-I (small aircraft) contain land uses that do not comply with the *Airport Design* requirements. Table 3.5 lists each RPZ and identifies the potential issues.

Table 3.5
Compliance Issues for Lake Hood Runway Protection Zones

RPZ	Compliance Issue	Notes
Approach to Runway 13	Not entirely owned by Airport Contains several residences	1999 Airport Layout Plan proposes using declared distances to comply
Approach to Runway 31	Contains approx. 12 float slips	
Approach to East Waterlane	Contains three on-airport buildings	
Approach to West Waterlane	None	
Approach to North Waterlane	None	
Approach to South Waterlane	Contains approx. four float slips and terminal area auto parking	
Approach to Northwest Waterlane	No RPZ depicted on current ALP, but RPZ would contain buildings in OAS complex	The Anchorage Pilot Bulletin and AK Supplement list this waterlane as active for use, but the ALP does not show an approach surface for this waterlane.
Approach to Southeast Waterlane	Contains one on-airport building	

The compatibility issue of most concern is at the northeast end of Z41, where several houses located on Wendy Way are within the RPZ. The 1999 Lake Hood Seaplane Base Airport Layout Plan proposed to use declared distances at the runway, extending the runway to the south and moving the north threshold southward so that the required RPZ would not extend beyond airport property onto the residential area. The on-airport buildings in RPZs are of less concern than the residences, but still non-compliant. An argument could be made that float slips, because of their similarity to auto parking, would be a permitted use in an RPZ.

3.1.4. FAA Taxiway and Taxilane Design Standards

Table 3.6 presents the taxiway and taxilane design standards for Airplane Design Groups I and II, according to *Airport Design*.

Table 3.6
Taxiway and Taxilane Design Standards

Design Category	Airplane Design Group I	Airplane Design Group II
Taxiway Centerline to Parallel Taxiway/Taxilane Centerline	69 feet	105 feet
Taxiway Centerline to Fixed or Moveable Object	44.5 feet	65.5 feet
Taxiway Width	25 feet	35 feet
Taxiway Shoulder Width	10 feet	10 feet
Taxiway Safety Area Width	49 feet	79 feet
Taxiway Object Free Area Width	89 feet	131 feet
Taxiway Edge Safety Margin	5 feet	7.5 feet
Taxiway Wingtip Clearance	20 feet	26 feet
Taxiway Longitudinal Gradient	+/- 2%	+/- 2%
Taxiway Traverse Gradient	1% to 2%	1% to 2%
Taxilane Centerline to Parallel Taxilane Centerline	64 feet	97 feet
Taxilane Centerline to Fixed or Moveable Object	39.5 feet	57.5 feet
Taxilane Object Free Area Width	79 feet	115 feet
Taxilane Wingtip Clearance	15 feet	18 feet
Taxilane Longitudinal Gradient	+/- 2%	+/- 2%
Taxilane Traverse Gradient	1% to 2%	1% to 2%

Taxiway V connecting to ANC exceeds design standards for Airplane Design Group I. The taxiway system serving Runway 13-31, which includes the parallel taxiway and Taxiways H1-H4, comply with the requirements for Airplane Design Group I.

The Lakeshore Drive and Floatplane Drive shared surfaces meet the design standards for Airplane Design Group I taxilanes. However, the shared surface taxilanes associated with the fingers have numerous instances where fixed or moveable objects are within 39.5 feet of the taxilane centerline, and/or are within the 79-foot wide taxilane Object Free Area standards.

3.1.5. FAR Part 77 Imaginary Surfaces

FAR Part 77, *Objects Affecting Navigable Airspace,* applies to all civil airports under the jurisdiction of the FAA. A seaplane base is categorized as an airport if it has visual markers identifying its waterlanes. Not all of the waterlanes are marked at LHD at this time. However, it has been assumed that FAR Part 77 will apply to all landing facilities at LHD.

According to FAR Part 77, the runways and waterlanes at LHD are defined as Utility (serving propeller aircraft of 12,500 pounds maximum gross weight) and Visual (no instrument approaches). Subpart C of FAR Part 77 defines obstruction standards and establishes imaginary surfaces with relation to the airport and each runway or water lane. The size of each surface is based on the category of each runway according to the

type of approach available or planned for that runway. The imaginary surfaces that apply to LHD and Z41 include the Primary, Approach, Horizontal, Transitional, and Conical Surfaces.

The Primary Surface is longitudinally centered on the runway or waterlane. For runways with a specially prepared hard surface, it extends 200 feet beyond each runway end. For all other runways with no hard surface or waterlanes, it ends at the end of the runway/waterlane. The width of the Primary Surface for Runway 13-31 and all three waterlanes is 250 feet. If a new runway were developed to serve aircraft over 12,500 pounds, the required Primary Surface width would be 500 feet.

An Approach Surface is longitudinally centered on the extended runway centerline and extends outward and upward, at a 20:1 slope, from each end of the Primary Surface. The inner width of the Approach Surface is the same as the Primary Surface. Each Approach Surface extends 5,000 feet and splays outward to a width of 1,250 feet.

The Horizontal Surface is a horizontal plane 150 feet above the established airport elevation, or 221 feet MSL. The perimeter of the Horizontal Surface is constructed by swinging 5,000-foot arcs from the center of the end of each primary surface and by connecting each arc with tangent lines.

Transitional Surfaces extend outward and upward at right angles from the Primary and Approach Surfaces at a slope of 7:1 up to 221 feet MSL.

The Conical Surface extends outward from the Horizontal Surface 4,000 feet at a slope of 20:1.

The 1999 Lake Hood Seaplane Base Airport Layout Plan depicts no penetrations to these imaginary surfaces.

3.1.6. Seaplane Base Requirements

FAA Advisory Circular 150/5395-1, *Seaplane Bases,* provides guidance for the planning and development of seaplane bases and is the primary source for the following requirements. Floatplane parking methods and standards are described in the section on aircraft parking and storage.

Water Operating Areas

Water operating areas should be at least 100 feet in width, with turning basins at the ends at least 200 feet wide. The E-W Waterlane is 188 feet wide, the N-S Waterlane is 200 feet wide, and the NW-SE Waterlane is 150 feet wide.

The FAA recommends maintaining a clear line of sight between the ends of all intersecting runways. Where this is not feasible to maintain, as with LHD's intersecting waterlanes, *Airport Design* identifies a smaller Runway Visibility Zone (RVZ). The RVZ is constructed by determining runway visibility points between each pair of intersecting runways and a line is drawn connecting the points. The resulting polygon is the RVZ, which must provide a clear line of sight at any point five feet above the surface. Several buildings on the south side of Lake Hood and buildings on the south end of the Commercial Finger obstruct the RVZ between the E-W and N-S Waterlanes.

Taxi Channels

The desirable width for taxi channels serving small airplanes is 150 feet. However, taxi channels may vary in width down to a minimum of 125 feet. The minimum recommended distance from a taxi channel centerline to piers, docks, or ramps is 60 feet. Waterborne aircraft can safely taxi past most obstructions as close as one-half their wingspan plus 15 feet. However, this factor should be increased in areas where high winds and currents are common.

There six taxi channels at LHD. Five of them are located between the slips in the finger areas and one is located in between the fingers and Gull Island. The taxi channels serving the finger areas are approximately 200 feet in width (shoreline to shoreline). The North Taxi Channel varies in width from approximately 225 feet on the west to 175 feet to the east (distance measured shoreline to shoreline).

Turning Basins

Turning basins are areas that allow floatplanes to maneuver and turnaround during taxi operations. Turning basins should be located adjacent to shoreline facilities and at the ends of the operating areas. Turning basins should be a minimum of 200 feet with a minimum of 50 feet from the nearest obstruction.

There are no areas specifically designated as turning basins at LHD. However, each waterlane end has at least 200 feet of area that can be used for turning and maneuvering.

Ramps

Ramps vary widely in size, shape, and construction materials. The simplest ramp consists of a wood plank platform approximately 15 by 20 feet laid out on the slope of the shoreline with half of its weight placed underwater permitting a small airplane to taxi up and out of the water. A minimum of 100 feet of unobstructed water should be available located directly offshore from the ramp. The ramp should be located in an area favorable to the prevailing wind conditions at the seaplane base.

One of the GA Plan issues is the need for an additional public ramp at the south end of Lake Hood to increase accessibility for floatplanes, to accommodate the deeper hulls of flying boat and amphibian aircraft, and to be protected from strong south winds. A ramp able to accommodate flying boats and amphibian type aircraft should be located in deeper water not subject to depth changes or be constructed on a hinge type system. The slope of the ramp should not be greater than 6:1 for typical floatplanes and should not be steeper than 8:1 for amphibians. A 4-foot depth of toe will provide sufficient clearance for most waterborne aircraft. A 3-foot depth will accommodate all but the heaviest amphibian aircraft. A ramp width of 30 to 40 feet will accommodate aircraft in most wind conditions. A ramp width of 15 feet is the minimum recommendation for small twin floatplanes in calm conditions. An additional five feet will allow operations in adverse wind conditions for these types of aircraft. LHD users should be consulted about the design of a new ramp to determine if the FAA ramp criteria described in this paragraph are adequate.

3.1.7. Lighting, Marking, and NAVAIDS

Runway 13-31 is equipped with Medium Intensity Runway Lights (MIRL) and is adequately lit. The taxiway parallel to Runway 13-31, connector taxiways H-1 through H-4, the taxilane and holding bay north of Delta parking, and Taxiway Victor are equipped with Medium Intensity Taxiway Lights (MITL) and are adequately lit.

The taxilanes associated with Lakeshore Drive, Floatplane Drive, the floatplane slips on the fingers, and the Lake Hood Strip parking do not have consistent marking or lighting. These surfaces are shared with auto and pedestrian traffic and present a danger for safe operations. In addition, the unusual taxilane layout at Lake Hood can be confusing to pilots unfamiliar with the facility. It is recommended that a taxiway/taxilane marking and lighting study be initiated to ensure consistency, separate pedestrian, auto, and aircraft traffic, and to promote the highest level of safety. Paving gravel taxiways and taxilanes would be a way to provide better marking and would have operational benefits (less mud, dust, and potential for gravel damage).

Floodlights from the shore light the E-W Waterlane. Additional lighting is recommended for the other waterlanes and for docking facilities. However, it is important to ensure that the additional lighting does not interfere (provide too much glare) with existing operations.

The South Waterlane is the only one that is marked. The marking that is in place is a large “S” sign. FAR Part 77 requires that all waterlanes be marked properly. Additional signage (preferably illuminated) should be added to the East-West, North, and Northwest-Southeast Waterlanes.

The Anchorage area has an adequate amount of enroute Navigational Aids (NAVAIDs). However, the LHD/Z41 facility has no terminal area NAVAIDs. In order to provide the highest level of safety, additional visual navigation aids are recommended, including a seaplane base beacon and marker, Precision Approach Path Indicators (PAPIs) for Runway 13-31, and Runway End Identifier Lights.

3.1.8. Aircraft Parking and Storage

Demand for aircraft parking and storage space at Lake Hood exceeds capacity now and demand is projected to grow in the future. The availability of water/snow, gravel, and paved landing surfaces at one place is a unique attraction in Anchorage. A single aircraft based at Lake Hood might be used with regular tires, tundra tires, floats, or skis, depending on the time of year or the destination.

Most aircraft at Lake Hood are parked on Airport-managed tiedown aprons. A few floatplanes are parked on aprons, but most are at the Airport-managed float slips along the shores of Lakes Hood and Spenard. About one-third of the based aircraft are on leased land--at float slips, on aprons, or in hangars. Table 3.7 indicates the distribution of aircraft parking at Lake Hood, wait-listed demand, and forecast demand for the short term (2008), intermediate term (2013), and long term (2023) future. Airport management has reported that when a space becomes available, approximately 25 percent of the people on the list decline the space.

Table 3.7
Lake Hood Aircraft Parking and Storage

Aircraft Parking Area	Current Capacity & Use	75% of Wait Lists	2008 Forecast Demand	2013 Forecast Demand	2023 Forecast Demand
Airport-Managed Parking					
Float Slips					
Based	341	175	356	370	403
Transient	8		8	9	9
Subtotal	349	175	364	379	412
Apron					
Alpha (based)	77		80	84	91
Bravo	55		57	60	65
Charlie	30		31	32	35
Delta	10	4	10	11	12
Echo	90	21	94	98	106
Lake Hood Strip	106	5	111	115	125
Total Based	368	30	383	400	434
Transient (Alpha)	15		16	16	18
Subtotal	383	205	399	416	452
Total Airport-Managed	732	205	763	795	864
Lessee-Managed Parking					
Float Slips	80		83	87	94
Apron	155		162	168	183
Hangar	105		109	114	124
Total Lessee-Managed	340		354	369	401
GRAND TOTAL	**1,072**	**205**	**1,117**	**1,164**	**1,265**

Notes:
Assumes transient spaces and lessee-managed spaces meet 100% of current demand
Assumes no lessee-managed transient spaces
Assumes transient growth rate = based aircraft forecast rate
Future capacity need not be distributed among parking areas in the same proportions as current capacity. For example, more may be in hangars or on leased land. Currently there are no public hangars where spaces can be leased like tiedowns.

Table 3.7 may underestimate demand for transient aircraft parking, as will be discussed in more detail later in this section. On the other hand, the wait list demand may be overstated. Some people waiting for a float slip are aircraft owners now using private facilities and preferring to relocate to LHD. If new floatplane parking areas at LHD are drydock or dock/slip facilities that do not provide the vehicle parking, individual storage buildings, or fuel storage capability of the existing slips, they may not be more desirable than the aircraft owners' current situations.

For virtually any type of parking—apron, slip, or hangar--approximately eight aircraft can be accommodated per acre. Consequently, the projected additional land area needed for aircraft parking and storage is as shown in Table 3.8.

Table 3.8
Areas Required for Lake Hood Aircraft Parking and Storage

	Additional Aircraft	Additional Acreage
75% of Wait List	205	26
2008	45	6
2013	47	6
2023	101	13
Total	398	50
Total without Wait List	193	24

The following sections describe the various types of aircraft parking and storage at Lake Hood and the types that might be built in the future.

Aprons

Existing tiedown aprons are paved and unpaved. Lake Hood Strip Parking is the only Airport-managed area that is not paved. Although unpaved aprons are cheaper, paved aprons help keep aircraft clean of mud and lessen the potential for aircraft damage from gravel. Paved aprons also provide advantages for snow removal, stormwater drainage control and treatment, and have paint markings that facilitate safe and efficient apron use. The new Echo Parking has electrical power available to individual tiedowns for a fee additional to the tiedown cost. Winter plug-in capability is desirable to many, but not all, tiedown permit holders. Apron parking at Lake Hood is used for wheeled aircraft and dry dock storage for floatplanes on dollies, or trailers. When used for drydocked floatplanes, aprons should be close to a public ramp.

The FAA recommends 300 square yards of apron per based aircraft and 360 square yards of apron per transient aircraft. Tiedown layouts in *Airport Design* indicate 670 – 800 square yards of apron per Airplane Design Group I aircraft including taxilanes.

Hangars

There are no Airport-managed hangars. All hangars at Lake Hood are on leased land and most are conventional hangars that hold more than one aircraft. About one-fourth of the aircraft based on leased land are in hangars, which equates to 10 percent of all based aircraft at Lake Hood. Total hangar area at Lake Hood is approximately 102,000 square feet, equivalent to about 1,000 square feet per aircraft. This number was derived from a survey of leaseholders and estimates for leaseholders who did not return the survey questionnaire.

Demand for hangars instead of apron parking depends on several factors, including weather, hangar cost, and the value of the aircraft. Virtually all the general aviation aircraft based at ANC in the South and East Airparks are in hangars. Unmet demand for individual hangars is reported by users and Airport management and is evidenced by the quick sale of aircraft "condominiums" by Silvertip, LLC. Silvertip is developing eight units located at the former Ketchum Air Service site on the Commercial Finger. All units have been sold prior to construction. The Silvertip development is especially attractive because each individual hangar will have direct access to Lake Hood on one side and direct access to the Floatplane Drive taxilane on the other side.

Conventional hangars are attractive for air taxis, government agencies, full-service Fixed Base Operators (FBOs), and corporate fleets of aircraft who perform maintenance on the aircraft, have tow equipment to reposition aircraft for maximum efficiency, and have office and other ancillary spaces in the building. For planning purposes, it is assumed future conventional hangars at Lake Hood will continue to be limited to lease land and be primarily used for commercial and government fleets.

T-hangars and row hangars provide efficient individual storage for small aircraft because individual hangars are attached to each other on the sides. Hangars might be developed with condominium ownership, like the Silvertip development. Alternatively, the Airport or a private entity, who would lease the individual spaces, might construct them.

T-hangars provide a T-shaped floor area for each aircraft and the individual T-shapes are nested back-to-back. Taxilane access is required on both sides. Depending on whether taxilanes serving the T-hangars provide one- or two-way traffic, 10 or 14 units will fit on an acre. Row hangars provide a rectangular area for each aircraft. They may be located where taxilane access is available on only one side or they may be placed back-to-back, like the T-hangars. "Taxi through" row hangars (similar to the Silvertip development) provide user convenience, but require more land area per aircraft since taxilanes are on both sides of each hangar. Building area per aircraft for T-hangars and row hangars would range between 1,200 and 2,500 square feet.

For future individual hangars at Lake Hood, the recommended planning factors are 2,000 square feet per aircraft and eight units per acre. A review of the Merrill Field Master Plan found that airport is planning hangar storage for 10 percent of the based aircraft in the future. According to the Juneau International Airport Master Plan, 22 percent of the general aviation aircraft based there now is in hangars. Based on this information, it is estimated that the owners of up to 25 percent of the aircraft based at Lake Hood would prefer hangar storage, if it were available.

Floatplane Parking

Seaplane Bases describes the criteria for shoreline slipways, such as exist at LHD. Slipways are typically rectangular and are dredged into the shoreline in areas where the water level does not change more than 2 feet. The dimension of the slipway should be 2 to 3 feet wider than the floats and 3 to 4 feet longer than the rudder down float length. The permitted land area for each float slip available at LHD is 50 feet by 50 feet, providing room for an aircraft, parked vehicle, and storage building. The four non-commercial fingers of Lake Hood are approximately 150 feet wide, providing two 50-foot deep slip areas and a 50-foot wide lane in the center for a shared surface (road and taxilane). At other parts of the shoreline, slips are directly adjacent to or a short distance from the road. Consequently, the land area per float slip is between 4,000 and 5,000 square feet. If new slips were developed without road or taxilane access, vehicle parking, or storage sheds, the land area required for a new float slip might be reduced to between 2,000 and 4,500 square feet.

According to *Seaplane Bases*, alternative methods for parking floatplanes are anchorage (mooring) areas, fixed docks, floating docks, and piers.

Anchorage areas are probably not appropriate for LHD, because of the large water area needed for each aircraft and the need for transporting people to and from the moored aircraft by boat. The south side of Spenard Lake might provide room for some floatplane anchorage, but would probably only be feasible for transient aircraft and if a vendor were responsible for the boat transportation. Center to center spacing for floatplane parking should be no less than two times the length of the anchor line plus 125 feet. An additional 100 feet should be added for flying boat and amphibian type aircraft.

Fixed docks stand on the bottom of a lake or river and are adjusted as the water level rises or falls. At least 100 feet of unobstructed water should be available in both directions from which approaches are made. Fixed docks should be located so that aircraft have access on both sides. When aircraft operate under their own power into, out of, or between mooring positions associated with fixed docks, the recommended separation between the limits of the mooring position is 30 feet. When aircraft are moved

by hand, the separation distance between the centers of the mooring positions should be no less than 60 feet.

Floating docks work in all water areas and can be designed to handle one or several aircraft. The length of a floating dock should be the design aircraft length plus 20 feet clearance both fore and aft. The floating dock should be designed to allow aircraft to dock on both sides with a 10-foot minimum clearance between wing tips. Floating docks can also be equipped with ramps on each end. These units are particularly useful and convenient for amphibian aircraft. Gangways usually attach a floating dock to the shore.

Piers are recommended where the variation in water level is 16 inches or less. Piers in effect are a more robust version of a fixed dock. However, they are built to accommodate vehicles such as pickup trucks and have no adjustable decking. Piers should be at least 8 to 10 feet in width. The mooring area for the floatplanes should be at least 3 feet deep.

Docks/piers built at seaplane bases in Southeast Alaska have typically been designed with individual ramps for the based aircraft, one ramp for transient aircraft haul-out, and areas for transient aircraft to moor (tie-up) parallel to the dock. With two rows of slips and a walking lane in between, the typical aircraft dock is 45 feet wide. Along the dock length, slips are spaced at 50 feet on center.

Transient Aircraft Parking

Lake Hood has eight transient float slips and 15 transient tiedowns. The transient spaces are full about three times a year—during spring and fall wheel/float changeover and during the Alaska Airmen's Association Alaska State Aviation Conference and Trade Show. The 23 transient spaces equate to only 2 percent of the aircraft parking and storage capacity at Lake Hood. At many airports, the percentage of parking capacity reserved for transients is greater. The number and location of transient parking spaces has been improved in recent years, but TAC members have reported that some transient pilots probably retain the impression that parking is scarce, inconvenient, and hard to find.

In 2001, the Aircraft Owners and Pilots Association (AOPA) analyzed the use of Charlie Parking by transient aircraft. In one year, Charlie Parking was used by 144 aircraft for a total of 1,046 days. Usage was as follows: 36% Anchorage, 36% Other Alaska, 27% Out of State, and 1% Foreign. The economic impact of non-local visitors using Charlie Parking in 2001 was projected to be over $200,000. Peak times were April and October, and in the summer months, usage was five to seven times higher than the usage in winter months.

A good portion of transient aircraft parking at Lake Hood is used by aircraft already based at Lake Hood that are transitioning between parking areas or changing floats/wheels/skis.

A questionnaire available to transient users of Lake Hood has produced few responses, but those responses are consistent with TAC members' recommendations that transient parking needs to be located for easy access to fueling, restrooms, pilot planning shelters, and other amenities. To the extent possible, transient parking should be consolidated. Wheeled transient parking is consolidated at the south end of Alpha Parking, near a stop for the Airport shuttle bus. Most floatplane parking is near Spenard Beach, within walking distance of Spenard Road and the bus stop and commercial businesses available there.

One TAC member suggested that if the Aviation Heritage Museum builds a replacement facility, the existing one would be a good hangar for transient/transitioning aircraft. For planning purposes, it is assumed that any transient hangar storage would be in a conventional hangar operated by an FBO or other Airport leaseholder.

Inactive Aircraft Storage

Several aircraft based at Lake Hood are infrequently used. One TAC member has suggested that a less convenient parking area should be provided so that the scarce float slips and tiedowns can be used by active aircraft.

3.1.9. Other Landside Facilities

The facilities described in this section include public amenities, aviation service businesses, aircraft fueling, aircraft rescue and firefighting, airport maintenance and administration, aviation museum, and air traffic control tower.

Public Amenities

Public facilities and services for Lake Hood that have been suggested by airport users and the TAC include additional pilot planning shelters, additional and permanent toilet facilities, pay phones, picnic facilities, and a campground.

The single wash rack available near the West Ramp is adequate now, because there is rarely a queue of aircraft waiting to use it. If the based and transient aircraft parking increases substantially, however, another wash rack might be needed.

Aviation Service Businesses

Although there are many businesses providing aviation services, no full-service Fixed Base Operator is located at Lake Hood. With the FBO facilities that already exist at ANC, it is unlikely that a Lake Hood FBO would provide the lush terminal, crew support, and

conference facilities that an FBO serving higher performance aircraft might provide. However, an FBO at Lake Hood might provide aircraft maintenance, storage, rental, charters, fueling, flight training, car rental, and a GA terminal facility consolidated in one facility. An FBO would need a leasehold larger than average, at least 2 acres, not including a portion of the aircraft parking and storage area listed in Table 3.8, that might logically be operated by an FBO. If float slips were expanded to accommodate the wait list, Lake Hood might support two FBOs.

Many other types of aviation services, such as air taxis and aircraft maintenance and repair, operate from lots that are 0.5 to 1.5 acre in size. As aviation activity grows, existing businesses may expand or relocate to a larger lot. A current example is Floats Alaska LLC, located on Aircraft Drive near Echo Parking. Floats Alaska recently became the Airport's Cessna Service Center and the business stores, constructs, and repairs aircraft floats. Floats Alaska plans to expand its float storage capacity by expanding to the east, leasing another acre of land. To account for such expansion of existing leaseholders, an estimated 3.5 acres should be reserved over the next 20 years (5 percent of the existing 68 leased acres).

As the market for their services grows, new businesses will likely establish at Lake Hood. Chapter One identified 32 aviation businesses and organizations operating from leaseholds at Lake Hood. If the number of businesses grows at the same rate as the based aircraft forecast (18 percent over 20 years), six new businesses would be established at Lake Hood. Assuming the land area required per business averages 1 acre, 6 acres of additional land should be available to lease to new businesses.

Lake Hood likely has latent demand for ancillary, nonaviation services, such as food, beverages, and retail (gifts, pilot supplies, and convenience items). It is assumed such concessions would be small and located within the premises of an FBO, other aviation business, or collocated with the public amenities described above.

Aircraft Fueling

Aircraft fuel usage is likely to rise as aircraft operations increase. Based upon the forecast increase in aircraft operations, between 15 and 28 percent over the next 20 years, it is unlikely that a significant increase in fuel storage would be needed. More frequent fuel deliveries might handle the usage increase, although fuel sales might grow more if aircraft parking is expanded to satisfy wait-listed demand, if mobile fuel storage is not allowed at tiedowns or slips in the future, or if market conditions result in lower prices at Lake Hood than at other regional airports. Facility needs in the future may relate to changes in level of service rather than increases in fuel flowage. For example, ACE Hangars and Fuel, which operates a self-service fueling station at Lake Hood Strip, is interested in providing a floatplane fuel station in the future. Such a station would likely

be at a dock next to the shoreline, where customers could moor their floatplanes, and where there is an upland area nearby for environmentally safe fuel storage. Additional fueling stations might be needed in the future for customer convenience, depending upon the future arrangement of Lake Hood. Less than half an acre would be needed for a fueling station.

Aircraft Rescue and Firefighting

Because Lake Hood is not an airport certificated under FAR Part 139, it has no requirement for firefighting apparatus, suppression materials, response time, or personnel. ANC is certificated, however, and response to an incident at Lake Hood is from the ARFF facility located in North Airpark via Taxiway V, unless another roadway route would be shorter. A rescue boat is housed near the West Public Ramp on Lake Hood. Any changes in runway, taxiway, lake, road, and fence/gate layout proposed in airport development alternatives should be evaluated to ensure response by firefighting apparatus or rescue boat would not be compromised by the change.

Airport Maintenance and Administration

Lake Hood is maintained from the Field Maintenance Complex located north of Aircraft Drive and east of the Post Office. The Airport will continue to need this complex after the Quick Turnaround facility by Charlie Parking is built. A significant increase in paved area at Lake Hood might require the purchase of additional snow removal equipment and hiring of additional staff. It is assumed the FMC could accommodate the increase in equipment and staff that might be required for Lake Hood.

Additional paved area at Lake Hood might also increase the required area for snow disposal. Depending on the relative location of new pavement and watersheds, a new snow disposal site might be needed. For planning purposes, it is assumed that any snow disposal area expansion needed would be moderate and could be accommodated at the existing site near Turnagain Pond, which primarily handles snow removed from ANC.

Lake Hood management and leasing personnel are located in sublet offices in the LakeAire complex. The location is good for customer service and has room to accommodate some expansion of staff. Future airport expansion and changes in airport layout and access control might require office relocation to maintain the same level of convenience to customers.

Aviation Museum

The Alaska Aviation Heritage Museum has requested a lease for the undeveloped land east of the ADOT&PF office building on the south side of Lake Hood to construct a new facility. Size and location requirements for the facility are unknown; therefore, it is assumed the area required is 4.5 acres, the approximate size of the requested site. The

Museum would retain its current leasehold for aircraft reconstruction, but may have hangar space available for sublease after the new building is built.

Air Traffic Control Tower (ATCT)

The Ted Stevens Anchorage International Airport Master Plan indicates that the ATCT now located on the east side of the ANC airfield will be relocated to the west side of the ANC airfield. When that occurs, Lake Hood air traffic will be harder to view. From the current tower location, there are areas of Lake Hood blocked from view by trees. Consequently, Lake Hood may need a separate ATCT in the future. The site of the Lake Hood ATCT that was decommissioned in 1977 is on the south side of Lake Hood and remains undeveloped. According to *Airport Design*, a typical ATCT site will range from 1 to 4 acres. The ATCT site must provide maximum visibility of the airport's traffic patterns. There must be a clear, unobstructed, and direct line of sight to the approaches, to all runways or landing areas, and to all runway and taxiway surfaces. Most ATCTs penetrate a Part 77 surface and are presumed to be hazards to air navigation until an FAA study determines otherwise. It would be better for an ATCT to penetrate a Transitional Surface than an Approach Surface.

Land Area Required for Other Landside Facility Requirements

Table 3.9 summarizes the estimated land area for the landside facilities discussed in this section.

Table 3.9
Additional Land Area (Acres) Estimated for Other Landside Facilities at Lake Hood

	2008	2013	2123	Total
Public Amenities	0.5	0.5	1.0	2.0
Fixed Base Operator	2.0	-	2.0	4.0
Business Expansion	1.0	1.0	1.5	3.5
New Businesses	1.5	1.5	3.0	6.0
Fueling	.5	-	.5	1.0
Aircraft Rescue and Firefighting	-	-	-	-
Airport Maintenance and Administration	-	-	-	-
Aviation Museum	4.5	-	-	4.5
Air Traffic Control Tower	-	-	2.0	2.0
Total	10.0	3.0	10.0	23.0

3.1.10. Lake Hood Surface Access and Security

Nearly all tiedown aprons, float slips, leaseholds, and public facilities at Lake Hood have adequate road access. Some roads providing access to float slips are gravel, rather than paved, but a well-maintained gravel road may be adequate for the light traffic in these areas. Access to recently acquired float slips in the northeast part of Spenard Lake is circuitous and on an unpaved surface needing improvement. A portion of the Aircraft Drive pavement, near the intersection with Lakeshore Drive is in poor condition and needs improvement.

Separate walkways do not parallel many of the Lake Hood roads, although pedestrians often travel through Lake Hood and are not discouraged from doing so by the lack of walkways.

The analysis of surface access at Lake Hood must go beyond providing adequate road and pedestrian access to aircraft, facilities, and businesses. Safety and security concerns about taxiing aircraft, vehicles, bicyclists, pedestrians, and pets sharing the same surface have been well documented in earlier parts of this report. Through-traffic and nonaviation recreational users of the shared surfaces cause the greatest concern. They are not at the airport for an aviation purpose and consequently are unfamiliar with or not focused on aircraft movement.

On the north side of Lake Hood, Lakeshore Drive provides the only surface for vehicles and taxiing aircraft. Providing a road/walkway separate from the taxilane at this location would lessen the hazard. However, even on the west side of Lake Hood, where Aircraft Drive provides a road surface that is separate from and parallel to the taxilane (Lakeshore Drive), shared use of Lakeshore Drive is reported to be a problem.

Fencing aircraft operating areas and controlling access through the gates might be the only effective way to resolve the problems arising from shared surfaces. All aircraft parking and movement areas could be fenced or just the most problematic areas. (For example, since aircraft do not taxi on the roads surrounding Spenard Lake, fencing might not be needed around the Spenard Lake float slips.)

Airport development alternatives should consider surface access improvements, such as providing more road and taxilane separation and providing access controls. Alternatives that control access should consider providing alternative access, such as a public road and walkway around the northeast side of Z41, or should acknowledge the impacts of restricting public access through Lake Hood, which occurred shortly after 9/11. Alternatives that control access to commercial businesses should consider alternative means of access for visitors and customers that might require gatehouses, consolidated parking and terminal areas outside the fence, courtesy vans, and shuttle buses.

Access control would enhance security, as well as a safety. An analysis of the specific characteristics of Lake Hood using TSA guidance resulted in the recommendation that Lake Hood should have access controls. According to Transportation Security Administration IP A-001, *Security Guidelines for General Aviation Airports*, May 2004, "To delineate and adequately protect security areas from unauthorized access it is important to consider boundary measures such as fencing, walls, or other physical barriers, electronic boundaries (e.g. sensor lines, alarms), and/or natural barriers."

IP A-001 contains an Airport Characteristics Tool to determine the security enhancements recommended for an airport's particular situations according to points assigned for specific airport characteristics. Points are associated with the following potential security concerns:

- Airport Location – a facility's proximity to mass population areas (over 100,000) or sensitive sites (e.g., an international port)
- Based Aircraft – Airports with larger numbers of based aircraft would not likely identify illegal activities that may be recognized at airports with small numbers of based aircraft
- Runways – Airports with longer paved runways are able to serve larger aircraft. Shorter, unpaved runways are not practical for use by large aircraft in poor weather conditions. Short, unpaved runways are less attractive as a launching point for illegal activities.
- Operations – The number and types of operations that are conducted call for different approaches to security.

Lake Hood's score is 27 points, as shown in Table 3.10.

Table 3.10
Lake Hood Points for Airport Security Assessment

Security Characteristics	Public Use Airport/Heliport
Within 30 nm of a sensitive site	4
Within 30 nm of mass population areas	5
Greater than 101 based aircraft	3
Over 50,000 annual aircraft operations	4
Part 135 Operations	3
Flight Training	4
Aircraft Rental	4
Total	*27*

The security enhancement recommendations for an airport with 25 – 44 points are:

- Access Controls

- Lighting System
- Personnel ID System
- Vehicle ID System
- Challenging Procedures
- LEO (Law Enforcement Officer) Support
- Security Committee
- Transient Pilot Sign-In/Out Procedures
- Signs
- Documented Security Procedures
- Positive Passenger/Cargo/Baggage ID
- All Aircraft Secured
- Community Watch Program
- Contact List

If a longer, paved runway were built at Lake Hood or if aircraft more than 12,500 pounds were based, maintained, or used in flight training at Lake Hood, 12 more points would be added to the score. The additional points would not move Lake Hood into a group of more demanding security enhancement recommendations. Unlike FAA Advisory Circulars, which contain guidance that must be heeded by airport sponsors who accept Airport Improvement Program grants, IP A-001 provides recommendations, not requirements.

3.2. GA Facilities at ANC

As described in Chapter One, there are three primary general aviation areas at ANC: the North Airpark, the East Airpark, and the South Airpark. The North Airpark generally accommodates lighter GA aircraft activity, while the East and South Airparks primarily accommodate corporate/business aircraft activity. For the purposes of this analysis, and consistent with the forecasts, the activity generated from the North Airpark is considered part of Lake Hood. Therefore, the facility requirements developed in this section are representative of the types of activity generated in the East and South Airparks. These activities are generally characteristic of operations conducted by larger corporate and business type turboprop and jet aircraft.

Two primary factors were used to derive future general aviation facility requirements: based aircraft and transient operations. The forecast provided based aircraft and total operations. Transient operations were determined based on an analysis of transient aircraft logs for Era Aviation and Signature Flight Support. From this information it was determined that transient aircraft operations equaled approximately 20.5% of total annual operations. This is assumed constant through the planning horizon. Table 3.11

depicts the forecast of based aircraft, annual operations, and transient operations that would operate out of the East and South Airparks for each planning horizon.

Table 3.11
ANC Transient Operations

Year	ANC Based Aircraft (a)	Operations per Based Aircraft (a)	Annual Itinerant Operations	Annual Transient Operations (b)
2003	41	647.7	26,556	5,452
2008	49	660.8	32,288	6,629
2013	58	647.1	37,532	7,705
2023	83	701.5	58,225	11,953

Notes: (a) Chapter 2, Table 2.8

(b) Assumed to be 20.5 percent of annual itinerant operations

Based on these assumptions, detailed GA facility requirements were developed using typical planning factors or ratios developed from existing facilities. Separate general aviation facility requirements were developed for each forecast year for the major general aviation components, including hangar, apron, and terminal. Based on these requirements, total acreage requirements were derived using existing facility ratios that account for ancillary facilities such as auto parking, fuel storage facilities, and buffer zones.

3.2.1. Aircraft Hangar Requirements

Demand for hangars exists for both based and transient aircraft. Typically, demand for hangar space is related to the local climate and the type of aircraft that operate at the airport. Areas with more severe weather conditions have a higher demand for hangar storage facilities. In addition, the large investments in jet and turboprop aircraft also increase the demand for hangar storage. For these reasons, ANC has a high demand for aircraft hangar storage. Facility requirements for based aircraft and transient aircraft are presented in detail below.

Based Aircraft Hangar

Currently there is approximately 100,000 square feet of hangar devoted to based aircraft. Thirty-six of the 41 aircraft based at Anchorage are stored in these hangars. Based on conversations with the FBOs, three of the five aircraft owners with aircraft that are not in hangars desire to have their aircraft stored in hangars.

Based aircraft are projected to double through 2023. As depicted in Table 3.12, the growth is primarily attributed to turboprop and jet aircraft. For planning purposes, it is assumed 100 percent of the future based aircraft will be stored in hangars. By applying typical space requirements for each aircraft type it is anticipated that hangar requirements will more than double through the planning horizon. Table 3.12 depicts based aircraft by type, average square foot requirement per aircraft and total hangar area required.

Table 3.12
ANC Based Hangar Requirements

Year	Based Aircraft Type	Number	Average Area (SF) Per Space	Area Required (SF)
2008	Single-Engine Piston	3	1,200	3,600
	Multi-Engine Piston	3	1,500	4,500
	Turboprop	16	1,900	30,400
	Jet	26	3,500	91,000
	Total	48		129,500
2013	Single-Engine Piston	3	1,200	3,600
	Multi-Engine Piston	3	1,500	4,500
	Turboprop	18	1,900	34,200
	Jet	34	3,500	119,000
	Total	58		161,300
2023	Single-Engine Piston	3	1,200	3,600
	Multi-Engine Piston	3	1,500	4,500
	Turboprop	20	1,900	38,000
	Jet	56	3,500	196,000
	Total	82		242,100

Source: HNTB Analysis

Hangar support space is typically associated each hangar. These areas are generally comprised of office and storage areas. There is approximately 32,700 square feet of existing support area associated with the hangars providing based aircraft storage. Support space requirements were developed by applying a similar ratio of support area to new hangar space.

The space requirements presented in Table 3.13 represent support space required for new hangars.

Table 3.13
ANC Based Hangar Support Space Requirements

Year	Hangar Support Space Requirements
2008	9,735
2013	20,229
2023	46,893

Transient Hangar

Era Aviation and Signature Flight Services provide approximately 44,000 square feet of transient hangar space. Based on discussions with the FBOs, the demand for transient hangar space is typically greatest during the winter months. In addition, the average length of stay during this time is typically less than one day. The requirement for transient hangar space was estimated by multiplying the existing ratio of hangar space to average day, peak winter month arrivals. Peak month transient operations were determined to be 8.8 percent of annual transient activity based on an analysis of the FBO transient logs. The existing ratio of hangar to average day, peak winter month arrivals is approximately 5,500 square feet. The increase in square footage requirements over based aircraft is attributed to frequent aircraft repositioning that occurs with this type of operation. A shortage of transient hangar will be experienced as early as 2008. Table 3.14 depicts the transient hangar requirements.

Transient hangar support space is included in terminal area calculations.

Table 3.14
ANC Transient Hangar Requirements

Year	Annual Transient Operations (a)	Peak Winter Month Transient Operations (b)	Average Day Peak Month Transient Arrivals (c)	Transient Hangar Space Requirements
2008	6,629	583	10	55,000
2013	7,705	678	11	60,500
2023	11,953	1,052	18	93,500

Notes: (a) Table 1

(b) Assumed to be 8.8 percent of annual transient operations

(c) Monthly transient operations divided by 31. Daily operations divided by 2.

3.2.2. Aircraft Apron Requirements

General aviation apron is typically comprised of based aircraft apron, transient aircraft apron and based aircraft hangar circulation apron.

Based Aircraft Apron

Since it is assumed that all future based aircraft will be stored in conventional hangars, no future based apron area requirements will be required.

Transient Apron

The itinerant apron is used for loading and unloading passengers and for short-term aircraft parking. Total existing itinerant apron area is approximately 34,500 square yards. Based on discussions with the FBOs, the demand for transient apron is greatest during the summer months. Transient aircraft also typically remain at the airport longer in the summer than in the winter. The length of stay can be as long as one week, with a typical length of stay of one to three days. For planning purposes, transient apron requirements were estimated by providing 1,200 square yards to average day, peak summer month arrivals assuming an average duration of two days. This planning factor provides parking and circulation for larger turboprop and jet aircraft. Existing apron utilization based on these assumptions is approximately 1,600 square yards per aircraft indicating an existing surplus of transient apron. By 2013, additional transient apron will be required. Table 3.15 depicts transient apron requirements.

Table 3.15
ANC Transient Apron Requirements

Year	Annual Transient Operations (a)	Peak Summer Month Transient Operations (b)	Average Day Peak Month Transient Arrivals (c)	2- Day Average Duration	Transient Apron Requirements (SY)
2008	6,629	762	13	26	31,200
2013	7,705	886	15	30	36,000
2023	11,953	1,375	23	46	55,200

Notes: (a) Table 1

(b) Assumed to be 11.5 percent of annual transient operations

(c) Monthly transient operations divided by 31. Daily operations divided by 2.

Hangar Circulation Apron

Hangar circulation provides access and staging for aircraft occupying the hangar. This area is typically calculated as a percentage of hangar area. For planning purposes, this area is 10 percent of the hangar requirements, in square feet, that is presented in square yards. Hangar circulation is included for both based aircraft hangar and transient aircraft hangar. Table 3.16 depicts the hangar apron requirements based on new based aircraft and transient aircraft hangar requirements.

Table 3.16
ANC Hangar Apron Circulation Requirements

Year	Total Hangar Circulation Apron (SY)
2008	4,050
2013	1,630
2023	4,210

3.2.3. General Aviation Terminal

The general aviation terminal building serves itinerant aircraft operations, which includes both based and transient aircraft. Services typically provided in the GA terminal include waiting area/pilot lounge, management/operations, public restrooms, concessions, circulation, and utilities. In addition to these areas, Era also provides VIP lounges and private conference rooms for their guests.

Era Aviation and Signature Flight Services have general aviation terminal facilities. The combined square footage of these two facilities is approximately 18,500 square feet. For planning purposes, it is assumed that future FBOs will provide a similar level of service that the existing FBOs provide. The current ratio of existing average day, peak month operations to terminal area was used to determine future facility requirements. Based on these assumptions, additional terminal space is required by 2008. However, the existing terminals could absorb additional capacity with a reduced level of service than is provided today. Based on the transient apron requirements, the FBOs would not necessarily have to expand their terminals to serve aircraft that would use this area through 2013. Table 3.17 presents future General Aviation Terminal requirements.

Table 3.17
Lake Hood and ANC Runways and Waterlanes

Year	Terminal Requirement (SF)
2008	23,170
2013	28,000
2023	41,500

3.2.4. General Aviation Facility Requirement Summary

Table 3.18 summarizes the facility requirements and deficiencies of each major GA component at ANC for each of the planning years. As depicted, all facilities will experience deficiencies by the end of the planning horizon (2023). By 2008, additional hangar space and circulation apron will be required. Total acres to accommodate these facilities were calculated so that land could be preserved to meet future requirements. A ratio of existing facilities to total area was determined and applied to the sum of the major components. This methodology accounts for ancillary components of the site including auto parking, fueling facilities and landscape and zoning buffers. As shown in Table 3.18, 18 acreages are required by 2023 to meet the additional requirements. This are could increase depending on airside and landside access requirements. The alternatives analysis will determine these additional requirements.

Table 3.18
ANC Facility Requirement Summary

		2008		2013		2023	
	Existing	Required	Deficiency	Required	Deficiency	Required	Deficiency
Hangar							
Based (SF)	100,000	129,500	(29,500)	161,300	(61,300)	242,100	(142,100)
Transient (SF)	44,000	55,000	(11,000)	60,500	(16,500)	93,500	(49,500)
Apron							
Transient (SY)	34,500	31,200	3,300	36,000	(1,500)	55,200	(20,700)
Circulation (SY)	(a)	4,050	(4,050)	7,780	(7,780)	19,160	(19,160)
Terminal (SF)	18,500	23,170	(4,670)	28,000	(9,500)	41,500	(23,000)
Total Gross Area Required (AC)	40	43	(3)	45	(5)	58	(18)

Notes: (a) Based on new hangar requirements